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No. 6



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CHINA REPORT SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

BRIEFS

SHANGHAI TECHNOLOGICAL CENTER--Since the smashing of the gang of four, the Shanghai scientific-technological information center has collected over 2 million pieces of foreign patented data. At present, it has on hand over 3,000 kinds of scientific-technological books and periodicals published in 30 nations and regions as well as research reports, academic meeting information and scientific papers from several countries. It has also collected nearly 7 million patented documents from the United States, Japan, Britain, France and West Germany. The center also analyzes and studies recent developments in science and technology both in China and abroad and promptly reports the results to leading organs concerned along with suggestions. After analyzing the history, status quo and trend of computer development in foreign countries, it made specific suggestions on the research and development of computers in Shanghai which leading departments have found important. This year, it has provided information on dozens of subjects to both Shanghai and other provinces and municipalities. [Shanghai City Service in Mandarin 1130 GMT 11 Aug 79 OW]

CSO: 4008

APPLIED SCIENCES

ROLE OF THE MISSILE SPEEDBOAT IN NAVAL OPERATION

Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 2, Apr 79 pp 2-4

[Article by Ren Yuan [0117 6678]]

[Text] It was Fascist Germany which began to use missiles toward the end of the World War II. Due to the technological limitations these missiles could be used to attack large targets such as the city of London but not small targets such as ships in the ocean. After the war, research and improvement of missile technology have been kept on. The anti-ship missiles were to appear toward the end of the fifties only after an important breakthrough was achieved in the field of electronics technology and construction of miniature rocket engines. Soon, the anti-ship missiles were put on board the highly mobile and maneuverable speedboats and a new type of warship was born--the missile speedboat.

During the third Mideast war of 1967, an Egyptian missile speedboat attacked and sank an Israeli destroyer "Eilat" which was approximately 10 times bigger in size than the speedboat. The navies of the various nations were jolted by this feat. Since then, research and construction of anti-ship missiles and missile speedboats sprang up everywhere like bamboo shoots after a spring rain. There are already more than 20 or 30 different types today. Since the fire power of a missile speedboat can match that of large size warship while its cost of construction can be very inexpensive, many third world nations in addition to the industrially advanced nations have equipped their navy with missile speedboats as an important tool for the defense of their territorial waters.

The Structure of Anti-ship Missiles

There are three kinds of anti-ship missiles: The ship-to-ship missiles carried on board ships, either floating or submerged; the shore-to-ship missiles installed on shore; and the air-to-ship missiles carried on board airplanes. The structures of all three types of missiles are alike. A single missile may be used for all three applications or a missile may be made into different types. Only the air-to-ship missiles do not require a "booster rocket" for the launching purposes, because it already possesses a certain initial velocity.

The structure of an anti-ship missile is similar to that of an airplane (Fig. 1). It has an airframe on which the wings are attached. The wings may be used to produce lift. It is even equipped with rudder and elevator which are used to control the flight of missile. The airframe contains

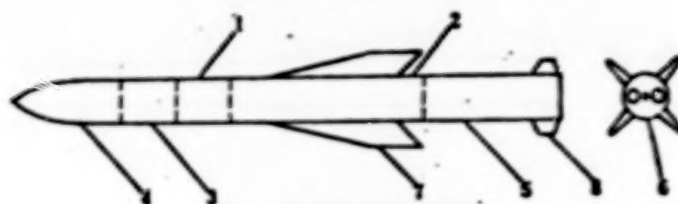


图1 反舰导弹结构示意图

Fig. 1 Construction of anti-ship missiles

Key:

- | | |
|-----------------------------|---------------------------------|
| 1. Warhead | 5. Booster rocket for launching |
| 2. Main engine | 6. Air frame |
| 3. Automatic control system | 7. Wings |
| 4. End guidance system | 8. Rudder |

warhead consisting of high explosives which is used to destroy the enemy ship. The main engine consists in general of a rocket engine or a jet engine which provides power to propel missile through the sky at high speed. If a liquid fuel is used, a special combustion chamber would be required. There is also an automatic control system. Its function are similar to that of a pilot in an airplane, to control the missile for smooth flight forward. The "tip guidance system" usually consists of a small radar or an infrared tracking system which help track and maintain aim at the target. A booster rocket is installed in a shore-to-ship or a ship-to-ship missile to help launch the missile. It is a solid fuel rocket engine having requirements different from that of the main engine. The booster rocket engine operates only for a very short period of time (a few seconds) and its thrust is very large (as large as a few tons or even a few tens of tons). The main engine, on the other hand, operates for a longer period of time (usually more than 100 seconds) and its thrust is small (a few hundreds kilograms or less).

The Structural Characteristics of Missile Speedboats

The missiles are carried inside launch tubes on board the speedboat. Each speedboat can carry 2, 4, 6 or 8 launching tubes, the number of tubes is determined by the size of the boat. The speedboat is equipped with a radar which is used to discover the enemy ship and measure the related data. It is further equipped with a command module, the nucleus of which is a computer which calculates the data required for launching of the missile based on various parameters concerning the movements of the enemy ship and itself. In addition, speedboat is also equipped with small gage cannons which can

shoot either horizontally or vertically and communications system as well as other systems which are the standard equipments of any speedboat. The speedboats of the world today consist partially of those ships designed especially for this purpose and partially of those remodeled from existing cruising speedboats or torpedo speedboats. They have thus inherited the characteristics of these boats including high speed, small displacement and great maneuverability. The displacements of missile speedboats today range from a few tens to a few hundreds of tons and an average cruising speed of 40 knots (1 knot = 1.852 kilometers per hour) or more. The power of the main engine is as high as a few thousand horsepower (Fig. 2).



图2 导弹快艇外观

Fig. 2 External view of missile speedboat

In recent years, the development of hydrofoil and air-cushioned boats is very rapid. These boats have even higher speed and are more maneuverable. Therefore, research and experiment are being done today to equip these new types of boats with the anti-ship missiles. This is an important movement in the field related to the development of ships.

As mentioned before, each missile speedboat carries 2-8 launch tubes. Therefore, as many missiles can be launched simultaneously. The average weight of the warhead in today's anti-ship missiles is approximately 100-500 kilograms. The weight may reach one ton or so in larger missiles. It consists of high performance explosives. It takes only 1-3 medium powered anti-ship missiles to disable or even sink an escort ship of 1,000-2,000 ton displacement or a destroyer which is slightly larger. Even a cruiser of 10,000-ton class or a larger aircraft carrier can be sunk or heavily damaged if it is hit by several anti-ship missiles.

When a warship having cannon power as its major weapon and a speedboat equipped with anti-ship missiles meet in a battle, the firepower superiority is usually on the side of the speedboat even though the warship may have a displacement much larger than that of the speedboat. The reasons are:

1. Missile range is longer. The effective range of anti-ship missiles is in general 20-40 kilometers or more. If other relay guidance systems are employed, the range can be extended to several hundred kilometers.

The range of 203 millimeter bore diameter cannons on a heavy cruiser of 10,000-ton class can also reach more than 20 kilometers, but its firing rate is low, no more than 10 shells per minute. It is very difficult to hit a highly maneuverable speedboat with this kind of cannon. The weapons that are effective against missile speedboats are the rapidly firing cannons of small to medium bore diameters. However, the effective range goes down with a reduction in the bore size.

2. The hit rate of missiles is high. According to the statistics gathered during World War II, the hit rate of an artillery shell on a large size warship as a target at a long distance was on average only 1-3 percent, and it is even smaller for small speedboats. On the other hand, the hit rate of anti-ship missiles was better than 70 percent if there were no interferences.

3. The missile warhead is very powerful. As mentioned before, it takes only 1-3 medium size anti-ship missiles to disable or even sink an escort ship having a displacement of 1,000-2,000 tons or slightly more. The shells of a medium sized cannot do not possess such power, and needless to say about the shells of smaller caliber.

Based on such statistics, it has been stated abroad that six missiles simultaneously launched possess an equivalent fire power of 35,000 shells fired simultaneously from medium sized cannons. It has also been said that a hydrofoil ship equipped with "whaling harpoon" (the name of a type of anti-ship missile) is equivalent to a World War II battle ship of 30,000-40,000 ton class in firepower.

The Conditions Under Which Missile Speedboats Enter Into Battle

As soon as enemy ships invade the defense line of the missile speedboats the troop would set out immediately. The radar on board the speedboats would search for the enemy ships. When the targets are displayed on the fluorescent screen, the type, number, speed and course of the targets are measured. The command module would then process these data with its computer and transmit data to the control and guidance systems of the missile. At the same time, the launch tubes would be turned to a direction ready for launching. An automatic checking system would automatically check over various parts of the missiles once more. When everything is ready, an indicator lamp in front of the commander would light up. At this moment, the commander would make up his mind and press down the "fire" button to ignite the booster rocket which produces huge thrust force to propel the missile toward the enemy ship. A few seconds later, the mission of the booster rocket would be completed and it would separate from the missile and drop off. The main engine of the missile would then begin to work. The missile would gradually come down and continue to fly at a minimum altitude in order to evade detection by the enemy radar. With the high precision radio altimeter on board the missile can come down to within a

few tens of meters of the ocean surface or even within 10 meters, just like sea gulls which skim the surface. At this juncture, the missile would automatically maintain its course and fly steadily by its own control system (which consists in general of an autopilot or a simple inertial guidance system). The speed of the missile is very high, reaching 300 meters/sec or more. As the missile approaches its target, the "tip guidance system" begins to work. The tip guidance system can search a large area of the ocean surface for the target. When a target is found, it goes into a tracking state, guiding the missile directly toward the target. When the missile hits the target, the warhead would explode and the enemy ship would be destroyed. The trajectory of a missile is illustrated in Fig. 3.

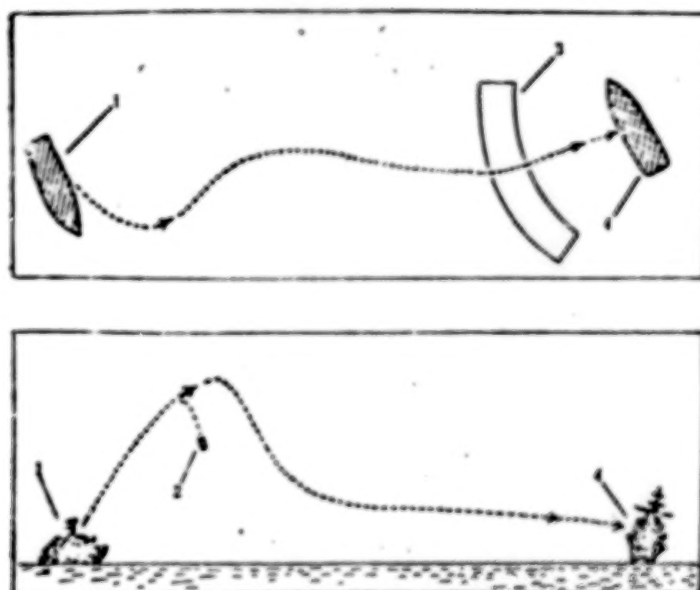


图3 一种反舰导弹的飞行轨迹

Fig. 3 The trajectory of a kind of anti-ship missile

Key:

- | | |
|----------------------------|----------------------|
| 1. Launching ship | 3. Radar search belt |
| 2. Booster rocket drop off | 4. Target ship |

An Actual Battle in Which Anti-ship Missile Was Used for the First Time

Israeli destroyer "Eilat" (standard displacement: 1,710 tons, length: 109 meters, maximum draft: 5.1 meters, carrying 4-114 millimeter main cannons and 6-40 millimeter antiaircraft cannons) was cruising the waters north of the Sinai Peninsula on 21 October 1967. She was cruising alone without air cover. At that time, the radar screen on the destroyer did not detect the presence of any Egyptian missile boat.

At around 1730 hours, the battle ship received a warning signal at a spot approximately 20 kilometers from Port Said that a missile is flying toward

her at that very moment. Ship's captain immediately ordered full-power forward (the ship's main engine is a steam turbine, dual-shaft, 40,000 horsepower, maximum speed 31 knots). Simultaneously, the main cannons as well as 40 millimeter antiaircraft cannons all opened fire against the missile, but failed to down the missile. The crew saw the missile constantly change its course and finally rush straight toward the ship. A few seconds later it hit the boiler room. In less than a minute, a second missile hit the engine room. It took only 70 seconds or so from the instant the missile was spotted by the ship to the instant the missile hit the destroyer.

The engine and boiler rooms of the destroyer were destroyed and burned fiercely. The ship tilted to one side and was unable to cruise. The radio system was also completely knocked out. This way, the destroyer completely lost its ability to combat, but to drift with the waves. At 1930 hours, a third missile hit the stern. "Eilas" gradually began to stand on its end and go under. At this point, ship's captain ordered "abandon ship." The crews jumped into the ocean or into the life raft one after another. A fourth missile arrived close behind the third one but fell into the ocean.

This was the first example of actual combat in which a medium size battle ship was sunk by the missiles since the invention of the ship-to-ship missiles. Some of the nations have strengthened their research and construction of anti-ship missiles and the missile speedboats since this incidence took place.

The Weak Points of Missile Speedboats

The small tonnage of missile speedboats contributes significantly to its mobility and maneuverability. However, the fuel and other reserves carried on board are proportionately small, enabling it to operate only a few days and nights in a stretch, and limiting the activities of missile speedboats in an area along the shorelines. Furthermore, under unfavorable natural conditions such as inclement weather and high waves, the power of the missile speedboat would be seriously curtailed.

Besides, the missile itself can be "interfered." Here lies the basic difference between missiles and artillery shells. Artillery shells once ejected can hardly change its course of trajectory arbitrarily. On the other hand, missiles are guided. As such they can be "unguided" or "mis-guided" toward a false target and thus disabled.

The greatest threat to the missile speedboat comes from the air. The so-called mobility and maneuverability of the missile speedboat are spoken relatively in comparison with that of larger ships. Because of its smaller tonnage, a missile speedboat is equipped, besides anti-ship missiles, only with small gage cannons which are used both horizontally and vertically.

As such, it does not possess large firepower against airplanes. If its opponent uses airplanes or anti-ship missiles to attack the missile speedboat, it must take an appropriate countermeasure or else be destroyed. To overcome this weakness, it has been suggested that a combat fleet consisting of 4-6 missile speedboats should include 1-2 speedboats which do not carry the anti-ship missiles. Instead, these boats would carry small size ship-to-air missiles and thus augment the antiair firepower of the fleet. The effectiveness of this idea has yet to be tested in an actual battle.

Another disadvantage of the anti-ship missile is the existence of a considerably large area of dead zone of attack. Namely, the area of the dead zone of attack is the "minimum range" of the missile. Within this range the missile is powerless. For some missiles this "minimum range" means a few kilometers. Therefore, most missile speedboats are also equipped with another type of firepower so that it will be able to deal with a surface target at short distances, in addition to the targets in the air.

(Drawings by Sui Zigeng [7131 5261 2577])

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CSO: 4008

APPLIED SCIENCES

DESTROYERS FOR THE FUTURE

Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 2, Apr 79
pp 5-7

[Article by Bo Liang [0130 5328]: "Small Water-line Area, Double-hull Destroyer"]

[Text] Destroyers as battle ships for the surface warfare have a history of more than 70 years' development and progress. Although significant changes have been made in such areas as tonnage, armament, performances and mission and application, when it comes to the ship's shape it cannot escape so far the conventional water displacing type single-hull construction. As such, its speed and navigational characteristics have not seen any drastic changes or significant leap forward in the past several decades, except for a series of local and fragmented improvements. With the progress of science and technology the standard for shipbuilding was also raised. In the past 30 years many new types of surface ships appeared one after another. For example, the hydrofoil and air-cushioned ships have broken away from the traditional regular water displacement type of ships. However, there are certain limitations to the applicable range of hydrofoils and air-cushioned ships. Application of these concepts to medium to large size destroyers still presents many problems. Therefore, how to open up a new territory and how to search for new shape of ships are the goals the designers and researcher of ships have been pursuing.

Since the sixties of the 20th century, a new type of ship known as semi-submerged, double-hull (or known alternatively as small water-line area, double-hull) ship caught the attention of many. The shape of the hull is half way between that of submarine and that of surface ship (Fig. 1).

This type of ship consists of three major parts: Lower body, above-water hull (or upper body) and strut. The lower body consists of two completely submerged floating bodies, parallel to each other and symmetrical, shaped like a submarine or torpedo, which produce the major part of buoyancy of the small water-line, double-hull ship. The upper body is a structure shaped like a rectangular box which remains completely out of water. Inside, there are cabins, and the topside is a broad deck area. The struts

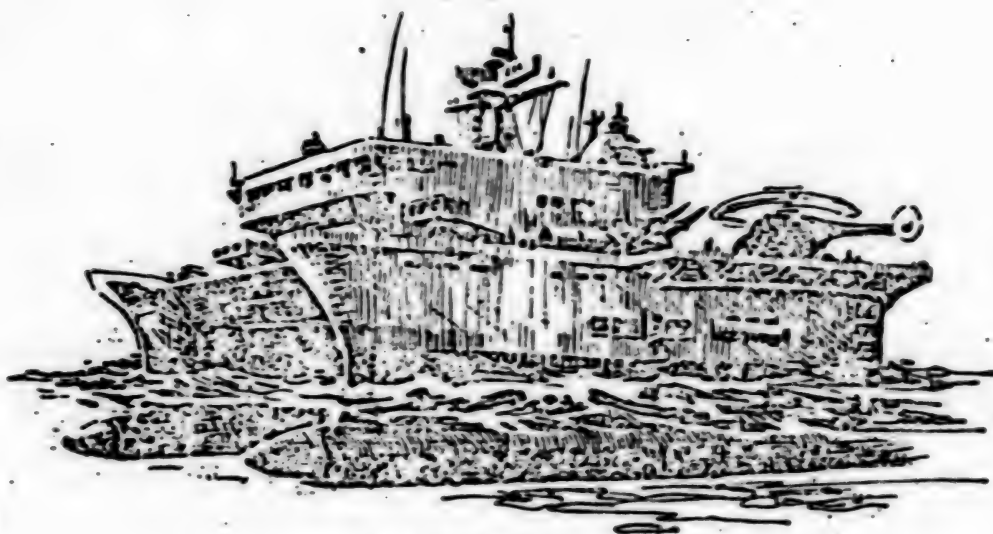


图1 小水线面双体驱逐舰

Fig. 1 Small water-line area, double-hull destroyer

are vertical wing-shaped columns joining the lower body and the upper body, while penetrating through the free surface of water. Inside the struts are the passages connecting the upper and lower bodies. Each lower body may be connected with the upper body with a single strut, two struts, or even a greater number of struts. The water-line cross-section of the struts are very slender. However, since these areas are distributed on either side and fore and aft with large distance between them, there exists sufficiently large area moment with respect to either the mid-lane or the mid-point lengthwise. Therefore, longitudinal as well as transverse static stabilities are sufficiently guaranteed. The submerged portions of the struts also provide a small amount of buoyancy. The superiority of this kind of special hull shape is manifested in the following areas:

1. Low Wave Drag

In the high speed range, the total drag force experienced by the small water-line, double-hull ship is smaller than the drag force experienced by the regular ship having displacement type hull. That is to say, for the same amount of power available its cruising speed can be greater than that of a regular ship having displacement type hull.

The hydrodynamic theory indicates that the total drag force experienced by a ship consists of three parts: The frictional drag, the form drag and the wave drag. The magnitude of the frictional drag is determined by the Reynolds number R_n (Note 1) and the total wetted surface area of the ship. Since variation in the cruising speed of most ships remains small, variation in Reynolds number is also small and, as a result, variation in the friction coefficient is small. Therefore, difference in the frictional

drag forces of a single-hull ship and a double-hull ship due to the difference in Reynolds numbers is insignificant. The main influencing factor here is the wetted surface area. The wetted area of a double-hull ship is approximately twice or more than that of a single-hull ship of the same displacement. Therefore, the frictional drag of a small water-line area ship would be more than twice that of a regular single-hull ship. The form drag remains fairly constant over a wide range of speeds, and no significant changes take place even if the hull shape is modified slightly. The wave drag, on the other hand, is very sensitive to either speed change or change in the hull shape. If the small water-line area, double-hull ship is to be superior than the regular single-hull ship in matters concerning drag, then its total drag must be either comparable or smaller than that of the single-hull ship. This cannot be realized at a low speed, because the frictional drag is the major component of the total drag in this speed range. The wave drag of a regular single-hull ship increases with an increasing speed and becomes the major component of the total drag at the higher speeds. This factor is the greatest obstacle to achieving high speed. It is the limitation that dictates the speed of the surface ships having displacement type hull. Therefore, how to reduce the wave drag becomes the core of the problem of attempting to raise the speed of high speed ships and boats.

Small water-line area, double-hull ships, having its main displacement volume--the lower body--completely submerged with very small water-line area presented by the struts, can effectively reduce the wave drag. Its superiority becomes more outstanding especially at higher speeds. Its total drag becomes significantly smaller than that of a regular single-hull ship. Fig. 2 shows some of the published results of research and experiment. It illustrates and compares the horsepower requirement of various types of ships of 3,000-ton class. It is evident from the figure that in the speed range of 30-50 knots the smallest power is required by the small water-line area, double-hull ship. Its drag situation is better than all other types of surface crafts including the hydrofoil and air-cushioned ships.

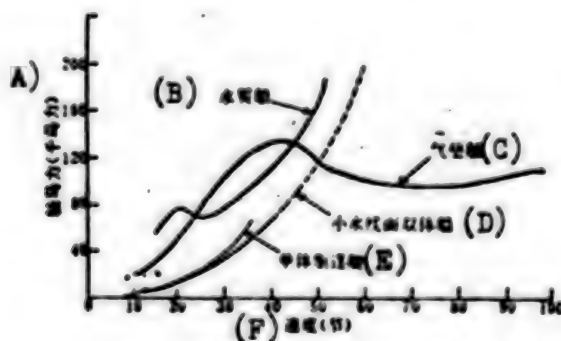


图2 各种3000吨级船所需功率的比较

Fig. 2 Comparison of power required by various types of 3,000 ton class ships

[Key on following page]

Key:

- | | |
|---------------------------------------|--|
| (A) Shaft horsepower (kilohorsepower) | (D) Small water-line area, double-hull |
| (B) Hydrofoil | |
| (C) Air-cushioned | (E) Single-hull destroyer |
| | (F) Speed (knots) |

2. Good Anti-wave Characteristics

We all know that any ship that travels over the ocean will encounter high wind and wave and navigational performance of a ship is often judged by its ability to deal with choppy sea. Many surface ships today often shake violently under unfavorable sea conditions caused by the severe disturbances and pounding of the wave. Under more serious circumstances such phenomena as wave over the deck, exposed screws and engine racing may take place. The drag increases drastically and the cruise speed goes down. On occasions, structural as well as equipmental damages may also result from such experiences. In order to reduce the amount of shaking of the ship, it is often necessary to reduce the speed of the ship or to change course. Speaking in terms of the surface ships, a more serious consequence is the fact that when the movement of the ship exceeds a certain sway angle all weapons will lose their effectiveness and the ship may become completely disabled as a fighting unit. However, at a certain depth the water is calm no matter how rough it is on the surface. Submerged submarine cruising under water is not at all affected by the waves on the surface. On the contrary, this is the best time for it to be active. Under such circumstances the surface ships are not only unable to carry out the anti-submarine operation but also become the best target for the submarine attack. This is evident from the above discussion how important good anti-wave characteristics are to the surface ships such as a destroyer as part of their tactical performance characteristics, and more so to the question of whether they can effectively accomplish their mission in battle situations.

The small water-line area, double-hull ships, having completely submerged lower body and small water-line area, are disturbed much less by the waves than the regular single-hull ship. So the amplitude of its motion caused by the waves is also proportionately small. The research and experimental results confirm that the amplitudes of the shaking motions in the longitudinal, transverse, and vertical directions are much smaller than the corresponding motions of the regular single-hull ships. Furthermore, the phenomenon of resonant vibration is totally absent. If horizontal controllable fins are installed on the lower body, the amplitudes of the longitudinal, transverse, and vertical shaking motions have been found to diminish even further and, at the same time, a very effective control of the ship can be achieved, so much so that a level floating state can be achieved. Control of the longitudinal and vertical shaking motions could not have been imagined on a regular single-hull ship.

The good anti-wave characteristics of the small water-line area, double-hull ships are not only manifested in the smaller amplitude of the shaking

motion but also displayed in the small loss in speed over a choppy sea and a relatively high cruising speed that can be maintained. Fig. 3 shows the ratio of drag in choppy sea to the drag in calm sea measured with a model destroyer having a single-hull and another having small water-line, double-hull construction. In the figure a greater value of H/L means larger waves.

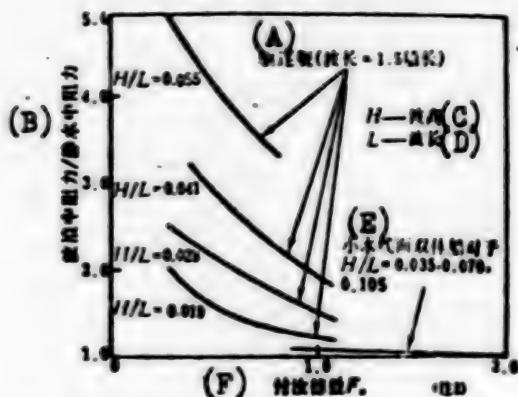


图3 波浪对常规单体型驱逐舰及小水线面双体船模型阻力的影响

Fig. 3 The effect of wave on the drag of model destroyers having regular single-hull construction and small water-line area double-hull construction.

Key:

- (A) Destroyer (Wave length = 1.5 ship length)
- (B) Drag in choppy sea/drag in calm water
- (C) Wave height
- (D) Wave length
- (E) Small water-line area, double-hull ship for $H/L = 0.035, 0.070$ and 0.105
- (F) Froude Number F_n (Note 2)

It is evident from the figure that the drag on a single-hull destroyer of today is very large in the choppy sea, reaching as high as five times that in the calm water or more. Fig. 4 compares the speed losses due to wave of 4,000-6,000 ton class ships having a regular single-hull construction and small water-line area, double-hull construction. As can be seen from Fig. 4, a ship with the regular single-hull construction loses speed significantly in waves of fifth degree magnitude, while a ship with small water-line area, double-hull construction can maintain considerably high speed even in waves of sixth degree magnitude.

3. Broad and Wide Deck Area

With the development in science, technology and weaponry, the limited deck area and cabin volume of many surface ships and especially those multipurpose

battle ships such as cruiser, destroyer and escort, are unable to contain various weapons, automatic control systems and detecting and measuring instruments, which are getting more and more complex each day. In contrast to this, the ships having small water-line area, double-hull construction possess a rectangular box type upper body having very high applicability rate from bow to stern, and a wide and broad deck area which may be used to install various types of weapons or to park the helicopters. For example, in order to be able to accommodate three anti-submarine helicopters a conventional anti-submarine destroyer would need a displacement of approximately 4,700 tons, but only 3,000 tons of displacement would be required of a destroyer having small water-level area, double-hull construction. Fig. 5 shows the relationship between the number of aircrafts carried and the displacement of destroyers and escorts having small water-line area, double-hull construction and conventional single-hull construction. It is quite evident from the figure that the superiority of the ships having small water-line area, double-hull construction in this regard over the ships of conventional design is unquestionable.

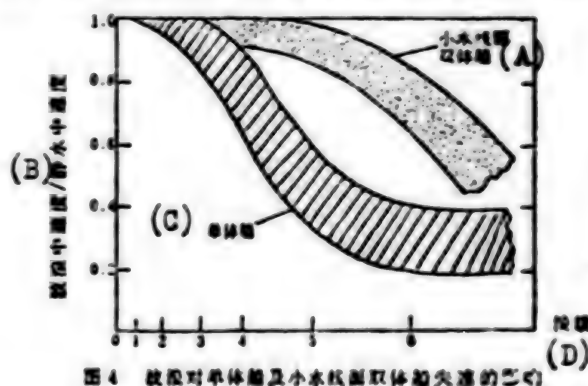


Fig. 4 The effect of wave on the loss of speed for ships having single-hull construction and small water-line area double-hull construction

Key:

- (A) Small water-line area double-hull ship (C) Single-hull ship
(B) Speed in choppy sea/speed in calm water (D) Wave magnitude degree

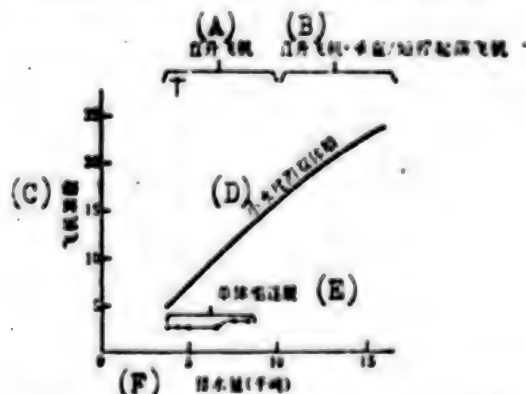


Fig. 5 Comparison of the numbers of aircrafts that can be carried on ships having small water-line area double-hull construction and single-hull construction

[Key on following page]

Key:

- (A) Helicopter
- (B) Helicopter + VT/STOL aircraft
- (C) Number of aircrafts
- (D) Small water-line area, double-hull ship
- (E) Single-hull destroyer
- (F) Displacement (1000 tons)

4. Increased Sonar Detection Efficiency

The noise generated by the ship itself in a high-speed cruise or cruising in a choppy sea often interferes significantly with its sonar reception in many surface ships of today. At a speed in excess of 25 knots or cruising through a choppy sea (especially if the ship shakes up and down violently) the sonar system becomes practically ineffective. Since ships having small water-line area, double-hull construction can cruise smoothly through a choppy sea with its lower body completely submerged and the noise level of its screws lower, the interference of the external noise on its sonar system is very small. This enables it to more effectively search, capture, identify and track the target and thus enhances the sonar detection efficiency and adaptability of the sonar system. The two parallel lower bodies of small water-line area, double-hull ship are also especially suitable for the proper arrangement of the sonar equipment. This has a special significance to those ships (such as destroyer, anti-submarine escort ship) whose missions include anti-submarine activities.

5. Simpler Construction Technology

Compared with a regular single-hull ship a small water-line, double-hull ship consists mostly of planes or circular cylinders. Therefore, the technology required for the construction is simpler, with a lower cost and a shorter period for construction.

Of course, ships having small water-line area, double-hull construction have shortcomings also. For example, the structural weight is greater and the wetted surface area is too big producing much larger drag at lower speed range than that produced by a single-hull ship. As a result, its maximum operational range is reduced for a given main power plant horsepower, a given amount of fuel and a designated cruising speed. The cross-section of the strut is too small to be suitable as living quarters or work cabins, it is fit only as storage area or passage way. The lower body is unfit as living quarters either, it is fit for installation of the main engine and for the storage of liquids. Its draft is deep which brings a certain restriction on its operation through narrow passages or shallow ports.

Nevertheless, the advantages it possesses are quite outstanding. When the advantages are compared with the disadvantages the advantages appear to be more outstanding. It has a broad and wide deck area, a low drag at higher

speeds, and excellent anti-wave performance characteristics. That is why when this new type of ship was first introduced, the navies of various nations immediately showed their strong interest in it, and it was applied first of all to the battle ships and works related to its research and development have been intensified and actively pursued.

At present, the navy of a certain nation is undergoing a process of developing anti-submarine escorts and destroyers of 4,000 ton class employing the small water-line area, double-hull construction. They are planning to apply this configuration to the construction of the helicopter carriers. According to one estimation, these new types of destroyers and other surface battle ships shall make their first appearance after 1985. The future of this type of ship is very bright. By the year 2000 or so, they may completely replace the destroyers and anti-submarine escorts of today having traditional single-hull construction and become a new generation of the future destroyers and medium to large size surface battle ships.

Note 1. Reynolds number (R_n): It is a dimensionless hydrodynamic similarity parameter considering only the viscous force and the inertia force. It is given by the formula $R_n = VL/\nu$, where V = velocity, L = length, and ν = kinematic viscosity of the fluid.

Note 2. Froude number (F_n): It is a dimensionless hydrodynamic similarity parameter considering only the weight and the inertia force. It is a dimensionless parameter which insures that the wave form generated by a model which is geometrically similar to the prototype and moving at a certain speed be similar to the wave form generated by the prototype moving at a corresponding speed. It is given by the formula $F_n = V/\sqrt{gL}$, where V = the speed of model or prototype, g = the gravitational acceleration, L = the length of the model or the prototype.

(Drawings by Sui Zigeng [7131 5261 2577])

9113

CSO: 4008

DEVELOPMENT OF GAS TURBINES FOR SHIPS AND VESSELS

Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 2, Apr 79
pp 23-25

[Article by Chen Zhao [7115 2507]]

[Text] In the previous issue we discussed the principle of operation of marine gas turbine together with its characteristics, method of application on ships and the new developments that are taking place abroad today. In this issue we shall go a step further and discuss the process of development of the gas turbines and the transition process from aviation to marine application.

From Remodeled Machine to the Early Special Machine

In the early stage of marine gas turbine development, the first machine used was a remodeled aviation gas turbine ("remodeled machine" for short hereafter). For example, in England in the forties, they dealt with several types of machines including G1, G2, and G4. The economic index of the aviation gas turbines ("original machine" for short hereafter) employed for the remodeling was very low and the period between overhauls was short. As such, most of them were employed only as a booster. They experienced various types of troubles after the machine was installed on board ship on account of the fact that the assembly was not so reliable.

To overcome the shortcomings of the early remodeled machines including the poor economic index, some all-purpose machines (a unit which can operate over the entire speed range of the ship from full-speed forward to full-speed backward) were later designed and constructed for the express purpose of marine applications ("special machine" for short hereafter). Special machine employed complex gas turbine cycle. The difference between the complex cycle and a simple cycle lies in the fact that in the complex cycle the air during its compression process is intercooled 2, 3 times in order to save some power spent on compressing the air. The complex cycle can recover some of the excess heat in the turbine exhaust gases. In a simple gas turbine cycle, the temperature of the exhaust gas is still as high as 400-500°C. A portion of this excess heat can be given to the air that is

about to enter into the combustion chamber using a heat exchanger called regenerator. For a constant gas temperature at the exit of the combustion chamber less fuel would be required to burn inside the combustion chamber. By saving some of the power required to compress the air and also reducing the amount of fuel consumed, the complex cycle improves the economic index of the entire assembly.

Fig. 1 shows the flow diagram of an all-purpose gas turbine engine assembly, Model RM60, which was developed in England from late forties to early fifties. It employs two-stage intercooling and a regenerator.

However, it was found out later that a gas turbine that operates on the complex cycle tended to be bulky in volume due to the many parts and complex structure of the assembly. As such, it fails to satisfy the original advantages such as simple construction, light weight, and compactness which are the features most suitable for the marine application. It was also found quite inconvenient to make proper arrangement and install the assembly on board ship. Its reliability was poor and, above all, it took too much time and labor to develop and to manufacture. As a result, this type of assembly did not gain further support and development.

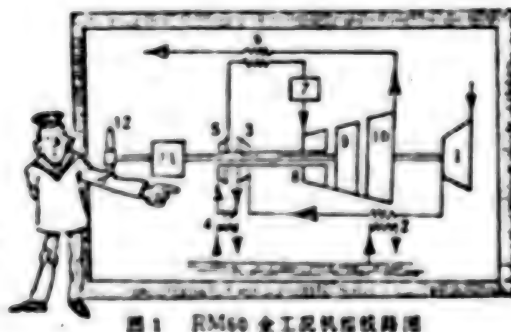


图1 RM60 全工况燃气轮机图

Fig. 1 The flow diagram of Model RM60 all-purpose machine assembly

Key:

- | | |
|--|----------------------------|
| 1. Low-pressure air compressor | 6. Regenerator |
| 2. Intercooler (1) | 7. Combustion chamber |
| 3. High-pressure air compressor (first stage) | 8. High-pressure turbine |
| 4. Intercooler (2) | 9. Medium-pressure turbine |
| 5. High-pressure air compressor (second stage) | 10. Low-pressure turbine |
| | 11. Speed reducer |
| | 12. Propeller |

In order to overcome poor anti-vibration characteristics and poor reliability of the early remodeled machines, attempts have been made to construct heavy structures such as Model EL60A gas turbine. However, this type of machine assembly was found to be too heavy (specific weight often exceeding

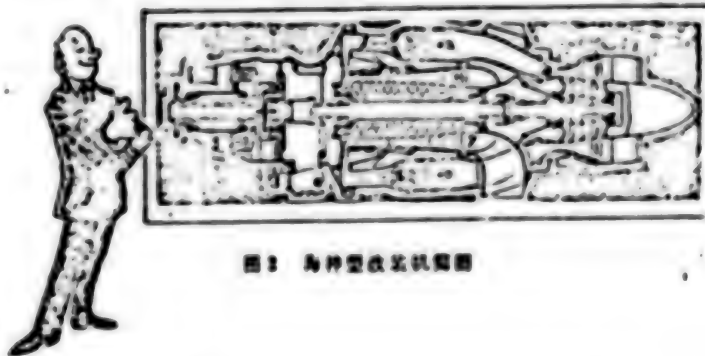
10 kilograms/horsepower). Its operation was found to be too sluggish, requiring more than 20 minutes from start-up to full-load operation. Its mobility was also inferior, and so the machine did not get any further attention. Likewise, machine assemblies such as Model TA8007 (specific weight 6 kilograms/horsepower) which was remodeled from a land machine in Switzerland and was successfully tested did not gain popularity any further.

Toward the end of the fifties, a so-called intermediate structure special machine--Model G6 booster--having a structure halfway between the aviation and land machines and a specific weight of 2.5 kilograms/horsepower was developed in England. Compared with its contemporary remodeled machines it excelled in reliability as well as anti-vibration characteristics. Its weight and dimensions were also suitable for marine applications. Special machines of this type were more successful and were used in small number on board ship.

Development of Machines Remodeled From Aviation Machines Is the New Trend

Since the sixties, the emphasis on the development of marine gas turbines abroad has shifted to the remodeled machines. The reasons for this shift are:

1. Toward the end of the fifties, England had successfully manufactured a remodeled machine called "Neptune" (Fig. 2), which was adopted by more than 10 nations and widely being used as the main power plant of small ships. The total number of units used has exceeded 200. This won a good reputation for the remodeled machines.



图：海神型改造发动机

Fig. 2 An illustration of remodeled machine Neptune

2. Since early sixties the development in aviation gas turbines has been very rapid. Significant improvements were made in many areas including power, fuel consumption and period between overhauls, and a great variety of types and models are made available. Therefore, it became more convenient to choose an original machine having good performance characteristics which is reliable and also easily adaptable to marine applications after remodeling.

3. It saves money, labor, as well as time to develop a remodeled machine than to develop a special machine.

4. As a result of a series of technological improvements including such technologies as anti-corrosion, conversion from kerosene to diesel burning vibration isolation, handling of gas generator through air ducts and boxed assembly, the technology of using remodeled machine on board ship has been perfected. Especially after a successful test of all-gas, combined power system on the British escort ship "Xmass" the reputation of the remodeled machine has been further enhanced.

5. Various aviation engine manufactures of the capitalist nations have extended their business into the remodeled machines. In order to gain market in the field of marine and land applications and to make profit they developed many multi-purpose machines.

It is thus remodeling aviation gas turbine has become one of the major routes of developing marine gas turbines in many countries.

There are two lines of design ideas today concerning remodeling of aviation engines:

One group employs machine assembly consisting of all-light construction such as FT-4 and LM2500 of the United States. Like its gas generator, the power turbine and reduction gear train of this system uses light construction of aviation type. The specific weight of the entire assembly amounts to only 0.5 kilograms/horsepower or so.

The other group employs a construction having light front and heavy rear. This type of construction consists of a light front end containing the gas generator which is remodeled from an aviation engine and thus can operate quickly and also can be installed or changed quickly. The power system consisting of the turbine wheel, reduction gear train and the related bearings which is not mechanically connected with the front end assembly employs a heavy construction for longer useful life. The British remodeled machine Olympus belongs to this type. Its specific weight is heavier than the all-light construction, amounting to approximately 1 kilogram/horsepower.

The Trend of Future Development

One of the main trends of the future development in the field of marine gas turbine would be the development of a special machine having as its nucleus a transplanted aviation turboprop engine. The reason: Viewing the overall development of the aviation engines today we see less and less development in pure jet and turboprop engines in recent years, and there is a trend that these will eventually be replaced by the turboprop engines.

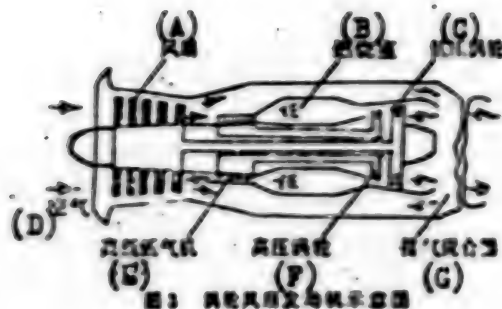


Fig. 3 An illustration of turbofan engine

Key:

- | | |
|--------------------------|----------------------------------|
| (A) Fan | (E) High-pressure air compressor |
| (B) Combustion chamber | (F) High-pressure turbine |
| (C) Low-pressure turbine | (G) Exhaust gas mixer |
| (D) Air | |

Fig. 3 illustrates an aviation turbofan engine. As can be seen in the figure, air which was compressed by the fan divides itself into two streams. One stream follows an external passage while the other stream follows an internal passage. The two streams eventually combine again in the exhaust gas mixer and exit the engine through the thrust nozzle. The high-pressure mechanical assembly consisting of the high-pressure compressor, combustion chamber and high-pressure turbine is called the nucleus engine of the turbofan engine. Compared with an ordinary jet engine, the thermal efficiency of the turbofan engine is somewhat lower, but because its exhaust gas speed is lower and the amount of air flow is larger the kinetic energy loss of the exhaust gas is significantly lower. As a result, its propulsion efficiency can be higher than an ordinary jet engine.

Because the conditions on board ship are different from that in the air, a series of modifications must be introduced to this advanced type of engine before it can be adapted to marine application:

First of all, speaking in terms of aviation turbofan engine, the compression ratio of the nucleus engine, which is the part to be adapted to the marine application, became smaller with an increase in the airplane velocity. Therefore, simply remodeling the nucleus engine would not make the entire machine performance to meet the requirement of marine application. In order to assure better performance of the remodeled machine, the turbofan and the original low-pressure turbine which drives the turbofan must be completely redesigned.

Secondly, other modifications are necessary because of the following conditions unique to the marine environment and application: The engine must be converted from kerosene to diesel burning. More salt will be contained

in the air as well as in the fuel. Various parts of the machine will receive more impact forces and vibrations. The air density is higher at the sea level than at a high altitude, therefore the thrust load on various parts of the machine components will be much larger. These factors necessitate introduction of the following modifications to the original machine:

(1) Since diesel fuel is more viscous and thus more difficult to atomize and burn and releases more radiative heat, relatively extensive modifications must be made to the major components of the original combustion chamber such as the fuel nozzle and the flame tube.

(2) In order to protect various parts from damage by corrosion, in addition to installing filter and air cleaner in the intake device and intake manifold most of the original mechanical parts must be replaced by better corrosion-resistant materials and the external surface of the machine must be protected by a coat of anti-corrosion paint or treated with a special anti-corrosion treatment.

(3) In order to adapt to an increased thrust load, in addition to replacing or strengthening the thrust bearing and the cylinder structure of the original machine every part which is subjected to the sliding friction must be treated with a special surface anti-friction, anti-corrosion treatment.

(4) To assure the anti-vibration characteristics of the remodeled machine the stiffness of the machine parts must be increased by such structural means as increasing the wall thickness of the original machine in addition to the use of vibration reducing devices attached to its mount.

(5) The regulation and control of the original machine need to be modified drastically, because the remodeled machine must be interfaced with the power turbine, reduction gear trains, the parallel transmission system and the propeller. There are more things that require regulation and control. In summary, as the demand and requirement on the remodeled machine (especially the demand on the period between overhauls) become more and more severe, the amount of remodeling that is required on the gas generator would be greater and the material and structure of the remodeled machine would become more and more different from that of the original machine.

Thirdly, there are a few advantageous conditions to the engines used for marine applications than the aviation engines: The requirements on the machine weight and dimensions can be relaxed. The requirement of the stable combustion inside the combustion chamber is not as strict as that for an aviation engine. The heat resistance of the turbine blade material may be a little bit inferior to that of an aviation engine. The advantages can be fully utilized in the process of redesigning the nucleus engine part of the transplanted aviation turbofan engine in construction of a special machine for marine applications. These are the reasons why transplanting the nucleus engine of an aviation gas turbine engine for the

construction of special machine shall be one of the main routes of the future development of marine gas turbines.

To improve the economic index of gas turbines a step further, in addition to what was described above attempts are being made abroad today to fully utilize the excess heat of the gas turbine exhaust gas in the form of an all-purpose, combined steam-gas power plant and an all-purpose, gas turbine system with regenerator of a new design. We shall not discuss these in detail here.

(Drawings by Tao Liming [7118 0500 3046])

9113

CSO: 4008

FROM NAVAL GUN, TORPEDO TO SHIP-TO-SHIP MISSILE

Beijing JIANCHUAN ZHISHI [KNOWLEDGE OF SHIPS] in Chinese No 2, Apr 79
pp 26-27

[Article by Shi Fei [2514 7378]]

[Text] We all know that there were many large-scale sea battles in World Wars I and II. The main weapons employed in these battles between ships used to be the cannons and torpedos carried on board ship. Since the end of the fifties some of the nations began replacing the main cannons and torpedos on board ship with ship-to-ship missiles as its main weapon on board ship. Why do they want to make such changes in the armament? Let's look at the table below first.

Name of weapon	Maximum range (meter)	Firing rate	Hit rate at maximum range
130 mm main cannon	25000	10 shells/minute	2%
533 mm torpedo	8000	fired once	20%
Styx missile	40000	2 missiles/minute	60%

It is easily seen in the table that the ship-to-ship missile is superior in performance over either cannon or torpedo in either range or hit rate. In addition, missile launching pad is lighter than the gun turret and so it will save some weight.

Then, why is ship-to-ship missile so much more superior in performance than either cannon or torpedo? To answer this question, we have better begin with the origin and structure of a missile.

Before the appearance of missiles sea battles often started out at a distance which was the maximum range of the cannons carried on board ship (25 km in case of 130 mm cannons). It took approximately 20-25 seconds from the instant the shell left the muzzle to the instant it reached its target. During this period of time an ordinary ship having a cruising speed of 35 knots or so could change its position by more than 300 meters from its original position by taking a swift evasive motion. The artillery

shell cannot change its course during its flight according to the position of its target by tracking its target. Furthermore, there are other factors such as scattering error inherent to the cannon and the wind pressure influencing the trajectory of the shell during its flight. As a result, the hit rate is usually very low.

How can we increase the hit rate of a bomb and fully display its power? One idea was as follows. While the bomb is flying through the sky, if it were able to look at the target and also change its flying conditions at will, in other words, if it possessed the ability to "track and pursue," then its hit rate could be increased significantly. At the same time, if it were possible to significantly increase the range of such bomb having the ability to pursue the target then the ship which owns it would have the initiative of an "originator."

Based on this idea and using some of the achievements of the modern industrial technology a bomb was fitted with an eye and wings, or rather a miniature radar, a miniature autopilot and a rocket jet engine. It was further made into the size of 450 mm torpedo to facilitate transportation on board ship. That is how the ship-to-ship missile was developed. Its total weight is usually no more than one ton, and its length is 5-7 meters or so. It consists mainly of the warhead, the "end guidance" system, the engine, the automatic control system and the booster rocket (Fig. 1).

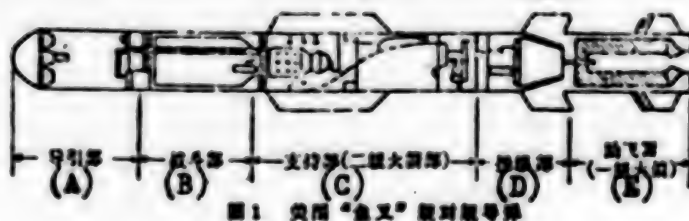


Fig. 1 American ship-to-ship missile "Harpoon"

Key:

- | | |
|---|----------------------------------|
| (A) Guidance system | (D) Steering section |
| (B) Warhead | (E) Booster (first stage rocket) |
| (C) Support section (second stage rocket) | |

The appearance of the ship-to-ship missiles has added a new color to the history of the sea battles. It has brought in a considerable degree of change to the scenes of traditional sea battles. During the third Mideast war of 1967, the Egyptian navy sank an Israeli destroyer "Eilat" with three "Styx" missiles launched from a distance of 23 kilometers by a Russian-made missile speedboat.

During the Indian-Pakistani war of 1972 the Indian navy sank a Pakistani destroyer "Kehaibar" again with "Styx" missile launched from a Russian-made missile speedboat.

After these two sea battles the United States of America and the Western European nations intensified their research and production of the ship-to-ship missiles one after another. For example, France succeeded in making her "Volan" missile, Italy her "Autuomatuo," Norway her "Penguin," United States her "Harpoon" and Israel her "Gabriel."

During the fourth Mideast war of 1973 the ship-to-ship missiles displayed once again their power. This time it was the Israeli missile speedboat using "Gabriel" missiles (combined with electronic interference tactics) and sinking 16 Russian-made missile speedboats of the Egyptian navy. After this, many nations of the world stepped up further their research and construction of the ship-to-ship missiles. United States and Russia, the two superpowers, produced one after another more new types of ship-to-ship missiles.

The main performance characteristics of a few representative ship-to-ship missiles of the world today are summarized in the following table.

(A) 国别	(B) 导弹型号	(C) 全长 (m)	(D) 总重 (kg)	(E) 动力	(F) 射程 (km)	(G) 速度 (Mach)	(H) 飞行高度 (m)	(I) 自动驾驶
(1) 苏	冥河	6.5米	860公斤	固+液二级火箭	40公里	0.9M	100~300米	惯导+雷达导的
(2) 以色列	迦伯列	3.35米	500公斤	二级固体火箭	40公里	0.65M	1.5~6米	惯导+雷达导的
(3) 法	飞鱼	5.1米	720公斤	固体火箭	40公里	0.93M	5~7米	惯导+雷达导的
(4) 美	鱼叉	4.5米	635公斤	固体火箭	100公里	1M	4~7米	惯导+雷达导的

Key:

(A) Nations	(A4) United States
(B) Missile types	(B1) Styx
(C) Total length	(B2) Gabriel
(D) Gross weight	(B3) Volan
(E) Power	(B4) Harpoon
(F) Range	(E1) Solid + liquid two stage rocket
(G) Speed	(E2) Two stage solid rocket
(H) Flying altitude	(E3 and E4) Solid rocket
(I) Self guidance system	(I1)-(I4) Inertia guidance + radar tracking
(A1) Russia	
(A2) Israel	
(A3) France	

When ship-to-ship missiles are used in a combat situation (Fig. 2), it will be able to manifest its power much better if it can fly low so as to be able to evade detection by the enemy radar.

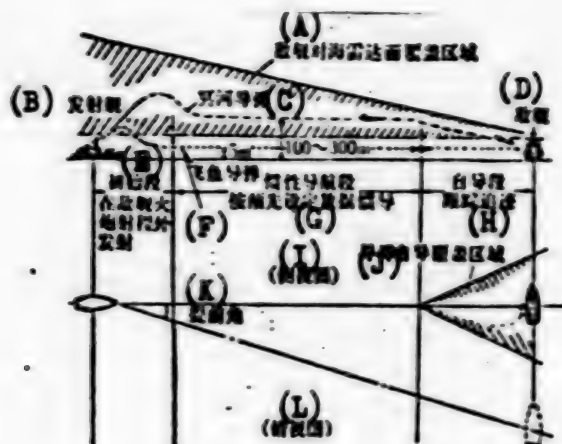


图2 舰对舰导弹作战示意图

Fig. 2 An illustration of ship-to-ship missile combat situation

Key:

- | | |
|---|--|
| (A) Enemy ship radar coverage area | (G) Inertia guidance navigation stage: Fly according to the predetermined data |
| (B) Launching ship | (H) Self-guidance stage: track and pursue |
| (C) Styx missile | (I) Side view |
| (D) Target ship | (J) Missile self-guidance coverage area |
| (E) Initial stage: launch from a spot beyond the range of enemy gun | (K) Advance angle |
| (F) Volan missile | (L) Top view |

With the progress of science and technology the ship's observation and communication capabilities are being improved each day, and various anti-air raid measures (including intercepting the ship-to-ship missiles) are being improved. Therefore, the requirements on the tactic performance characteristics of ship-to-ship missiles are getting more and more severe in order to be able to meet the demand of a modern warfare.

First of all, the ship-to-ship missiles must have a longer effective range so that an attack can be initiated from a safe distance.

At the same time, the self-guidance system must become completely independent. It must possess the capability to automatically and effectively "guide" itself.

Furthermore it must be able to skillfully evade detection by the enemy radar and dodge attacks by the enemy weapons. It must possess the capability to resist interference and a stronger survivability.

In addition, it must use high power explosives and non-contact type fuse in its warhead in order to increase the combat power of the ship-to-ship missiles.

Note: M(Mach) is a unit of velocity. 1 M = 1 sonic velocity

(Drawings by Sui Zigeng [7131 5261 2577])

APPLIED SCIENCES

BRIEFS

NEW EARTH SATELLITE MOTION--Nanjing, August 3 (XINHUA)--A new method for calculating the motion of the man-made earth satellites has been developed by Chinese astronomers at the Purple Mountain Observatory here. The new method is called second order perturbation theory with semi-analytical and semi-numerical integration. It involves simpler formulae and less computation than other methods, and also is more accurate. Satellite motion up to now has been calculated using either the analytical method or the numerical method. The analytical method is complicated and its terms sometimes amount to tens of thousands. The numerical method is precise and simple, but requires enormous calculations. Chinese astronomers in other parts of China think their colleagues in the Purple Mountain Observatory have absorbed good points of both older methods into their new method. It gives a new theoretical base to China's development in satellite surveying and navigation. The Purple Mountain Observatory, a unit under the Chinese Academy of Sciences, is the largest observatory in China. [Text] [Beijing XINHUA in English 0842 GMT 3 Aug 79 OW]

MOBILE PROSPECTING LABORATORY--Hangzhou, 21 Jul--A mobile laboratory for geochemical prospecting recently manufactured in Hangzhou is the first of its kind in China. The mobile laboratory, which is air conditioned, shock-proof and dustproof has optical analytical instruments as well as other chemical equipment with which a quick analysis can be made for 30 common elements in geological samples. It is for use in areas where transport is inconvenient and temperature varies greatly in a day. [Text] [Beijing XINHUA in English 0142 GMT 21 Jul 79 OW]

CSO: 4020

Experimentation

AUTHOR: LIU Jianye [0491 1696 2814]

ORG: None

TITLE: "Electric Welding and Health"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979
pp 20-22

ABSTRACT: It has been onown for some time that electric welding can have a deleterious effect on health. During welding, both finely dispersed particulate matter and gases are given off. Fine droplets of metal are inhaled and combine with proteins in the body to make foreign proteins which are then attacked by the white blood cells; the result is so-called "metal fever." Particularly poisonous are the various fluorides of alkali and alkali-earth metals which are present in the smoke, as well as gases such as carbon monoxide, carbon dioxide, nitorgen oxides and methane. Experiments indicate that of the fluorides, those containing potassium are most poisonous and those containing calcium least so, with those containing sodium in between. New types of welding rods developed in China present a much lower danger from fluorine compounds and are superior to the latest Japanese and Czech developments.

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2. SHEN Taichang [3088 3141 2490]

ORG: None

TITLE: 1. "Subsonic Weapons"
2. "Attacking the Tank"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979
pp 26-27, 28-29

ABSTRACT: 1. It has been suggested that subsonic weapons might turn out to be of major importance in warfare. Vibrations with frequencies of 0.001-20 Hz can cause discomfort and disorientation in humans at relatively low levels, and at high intensities (185-195 dB) have been shown to kill monkeys. These low frequencies match the resonant frequencies of bone and internal organs, disrupting body structure. However, there is at present no indication that subsonic weapons have a future, because the large intensities required outdoors are hard to attain.

2. Antitank weapons include rocket-propelled grenades, recoilless rifles, antitank guided missiles, missiles with sensor homing, bomblets, and the neutron bomb.

AUTHOR: ZHEN Sui [4176 4482]

ORG: None

TITLE: "How Are Leaks Detected?"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979
pp 30-32

ABSTRACT: It is important to detect leaks in such objects as radio and television tubes, space suits and nuclear equipment. Relatively large holes can be detected by appearance of bubbles when the object, filled with gas, is immersed in liquid. Smaller leaks can be detected by filling with ammonia and painting external surfaces with bromphenol blue. Certain diodes increase their conductivity in the presence of halogen gases and thus can test for leaks. Sparks from a high-voltage probe collect around holes in glass objects. Leakage of helium can be detected by mass spectrometer in small amounts; more recently the "reverse flow" spectrometer has appeared. A major cause of semiconductor component failure is leakage in the packaging. A semiconductor package in high-pressure helium will absorb some helium if it has a leak; subsequently placed in a vacuum, it will release helium, which can be detected by the above-mentioned techniques.

AUTHORS: XU Ruyuan [6079 1172 3293], TANG Guanzuo [3282 7070 4373]

ORG: Jiujiang [0046 3068] Concrete Ship Experimental Plant

TITLE: "Concrete in Steel Cylinders"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979
pp 32-33

ABSTRACT: Strong and relatively light structural supporting members for buildings, turbine installations and the like are made by packing concrete into welded steel cylinders (or around the outside of them). Ordinarily the failure mode for concrete, even reinforced concrete, is brittle failure; but when it is enclosed in a steel cylinder the tendency to brittle failure disappears and columns made in this way undergo plastic deformation just as steel columns would. Structural members of this type have been studied in China since 1963. China's first 600 kW thermal electric power station uses 621 tons of such structural members; if steel members had been used, 1,450 tons would have been required.

AUTHOR: None

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TITLE: "A Fast-Growing Tropical Lumber-Producing Tree: the Tuanhua"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979
p 39

ABSTRACT: A search for fast-growing trees has identified the tuanhua [0957 5363] tree, which grows in the tropical regions of the Americas and Asia; its range extends into Yunnan and Guangxi. In 10 years this tree can grow to a height of 20 meters and a diameter of 30 centimeters. Its wood is relatively strong, is easy to work and is suitable for various building and furniture uses. A study of its requirements indicates that it can survive temperatures to 0° C but needs 1,200 mm of rain a year and an acid soil. Some successes has been experienced in transplanting to the Canton area. A disadvantage of the wood is that it is not very resistant to rot and is attacked by various insect pests.

AUTHOR: None

ORG: None

TITLE: None

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979
pp 44-45

ABSTRACT: The following items are introduced: 1. the JS-1 precision sound level indicator, developed by the Acoustics Laboratory, Institute of Physics, CAS, and the Hengyang Instrument Plant; 2. a deflection gauge developed by the Ningbo Red Flag Instrument Plant; 3. a precision digital thermometer (JWC-1) developed by the Hebei Province Coalfield Geological Survey Company and the Xingtai [6717 0669] Municipal Electronics Institute; 4. a wireless receiver for relaying radio signals to a microphone to remote loudspeakers, made available in 3 models (1 FM, 4 FM-3, 8 FM-2).

AUTHOR: None

ORG: None

TITLE: 1. "Learn Humbly from Foreign Countries, Speed Up Implementation of the Four Modernizations"

2. "A 6,000 Kilovolt Outdoor Voltage Pulse Generator"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979 inside front and back covers, p 48

ABSTRACT: 1. Chinese workers learn from the following: American-born scientist Ren Zhigong [0117 0037 1872], now a professor of Electron Physics at Qinghua; Danish harbor construction experts; an American chemical fertilizer production expert; a French compressor expert; American nuclear physicist Deng Changli [6772 2490 7812]; a Canadian systems engineer.

2. A 6,000-kV outdoor voltage pulse generator with 30 stages, a power of 300 kW and a height of 20.5 meters at the High-Voltage Test Ground, Peking Institute of Electric Power is described. The apparatus works by avalanche discharge of capacitors.

AUTHOR: LIU Renqing [0491 0088 1987]

ORG: None

TITLE: "The Science of Packaging"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 4, 1979 pp 10-11

ABSTRACT: The importance of packaging of both industrial and consumer goods has been recognized. Producers take care with the external appearance of packages and on their shape and material. The properties of the materials themselves have been altered: glass can be made unbreakable, paper waterproffed and metal rolled out into foil. The advent of plastics has had a revolutionary effect. Laminates, consisting of layers of paper, plastic and foil, are of particular importance in packaging moist materials. Machinery, often computer-controlled, facilitates fast packaging. Three important types of packaging are: air-current packing, shrink sealing, and vacuum packaging. With the new Communist Party emphasis on modernized socialist construction, the study of modern ways of packaging takes on increased importance.

AUTHOR: 1. None
2. ZHANG Kaisun [1728 7030 6676]
3. LUO Jianlong [5012 6015 7893]

ORG: None

TITLE: 1. None
2. "Electronic Fire Alarms"
3. "A Simplified Introduction to Automated Laser Typesetting"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 5, 1979
pp 17, 18-19, 20-21

ABSTRACT: 1. The following are described; an organic photoconductive material for xerography developed by the Institute of Chemistry, CAS; the SYB-J fluid pump, designed to replace suspended bottles in intravenous irrigation and blood transfusions; a device for giving injections without a hypodermic needle, developed by the Luda Pediatrics Teaching and Research Group.

2. Warning of fire can be given by smoke detectors, detecting either particles or ions; photosensitive devices to detect flame; heat sensors.

3. In laser typesetting the light of a laser beam is reflected off a rotating mirror whose faces are marked with letters; the light is reflected onto a photosensitive plastic, and development produces a plate for printing.

[continuation of KEXUE SHIYAN in Chinese No 5, 1979 pp 17, 18-19, 20-21]

For Chinese, with its thousands of characters, such a mirror arrangement is not feasible, but a new method of breaking down characters developed by the workers of the Electrical Engineering Instrumentation Institute in Shanghai may help solve the problem.

AUTHOR: LIU Shaoqiu [0491 4801 3808]

ORG: None

TITLE: "Antiballistic Missiles"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 5, 1979
pp 22-23, 35

ABSTRACT: The idea of the antiballistic missile was developed during the 1960's. The missile itself consists of a warhead, a rocket vehicle and a guidance system. Since enemy rockets which it is intended to knock out fly at speeds up to 7 km/second and total warning time is only about 30 minutes, speed is of the essence; the missiles must be easy to launch and maneuverable. Enemy missiles are detected by radar. They must then be identified and decoys and chaff distinguished from them. Behavior on reentry into the atmosphere is the main method of doing this. Tracking radar is used to guide the missile to its target. Chances of success are increased by having systems of missiles for 2 or 3 different altitudes and concurrent use of high-energy laser beams and charged particle beams.

AUTHOR: CHU Yilin [2612 3015 7792]

ORG: None

TITLE: "Miraculous Scouts in Space: Satellite Reconnaissance"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 5, 1979
pp 36-38

ABSTRACT: The development of reconnaissance satellites in the early 60's enables the United States to discover that the Soviet lead in missiles was almost nonexistent. Reconnaissance satellites fly high and can cover considerable terrain; can fly over all areas undeterred; have extremely high optical resolution; can fly for long periods without consuming energy; and fly in a steady path. They are generally in orbits 150-200 km high and from this height can distinguish makes of trucks and aircraft. Infrared and microwave reception allow them to continue detection at night and in overcast. When all the film in a satellite magazine is used up, the magazine is parachuted to earth. Pictures can be broadcast back to earth if real-time monitoring is required. The Soviets have launched far more reconnaissance satellites than the U.S., but the U. S. "Big Bird" satellite has remarkable capabilities: resolution, film capacity and longevity. Many nations are developing such satellites.

AUTHOR: HUA Wei [5478 1792]

ORG: None

TITLE: "Microcomputers"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 5, 1979
pp 33-35

ABSTRACT: The advent of microminiaturization in the 70's has led to the birth of the microcomputer, which differs from the minicomputer in that its central processor is on a single LSI chip. A typical chip, the Intel 8080 processor, is described. A photo of the DJS-050 microcomputer is supplied. Microcomputers do not have the capabilities of minicomputers (8-bit byte, relatively slow speed), but their small size makes them suitable for installation on various types of instruments to allow them to operate automatically; for control of machinery; and for use in distributed systems, particularly in the form of intelligent terminals. Multimicroprocessor systems are becoming an important computing tool. The development of Chinese LSI circuitry and computer engineering will lead to the production of Chinese microcomputers.

8480

CSO: 4009

AUTHOR: Yang Xiongli [2799 7160 6849]
Liu Yumin [0491 5148 3046]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Photopic Luminous Efficiency Curve of the Chinese Normal Observers"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 105-120

TEXT OF ENGLISH ABSTRACT: 1. The photopic luminous efficiency curves of 34 young Chinese subjects with normal colour vision were determined by flicker method, using a 2° foveal field at a retinal illumination of 60.7 td. The sensitivity maximum of the average curve locates at about 550nm. In comparison with the 1924 CIE V_1 , the present determination between 450-700nm fits in closely, while that between 400-450nm falls close to the Judd's corrected value. Owing to the yellowing of the lens, the V_1 at short wavelengths shows a tendency of decrease with increase of age.

2. The variation in the determination of the V_1 function for a given subject is only about 1/4.5 to 1/1.5 of the group variation.

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp 105-120]

3. With reference to the V curve determined at 60.7 td, the curve determined between 470-650nm at 765 td shows no change of shape or sensitivity maximum, while at 4.2 td, some broadening of the curve is observed. Some effect of the spectral composition of the comparison light in the determination of the V curve was also observed.

4. For the sake of comparison with the normal, the V_1 curves of 3 protanopes and 2 deuteranopes were determined.

5. The effect of individual variation, age and other aspects such as racial differences on the V_1 function are discussed in light of the present investigation.

AUTHOR: Jin Guozhang [6855 0948 4545]
Han Yifan [7281 1837 0416]
Yu Leiping [0358 5628 1627]
Feng Jie [7458 3381]
Wang Fansheng [3076 5400 3932]
Zhang Zhende [1728 2182 1795]
Zhang Anzhong [1728 1344 0022]
Sheng Meiping [4141 5016 5493]
Lu Yanyan [0712 3601 3601]
Shi Guofu [4258 0948 1381]
Wang Lijuan [3769 5461 1227]
Hu Jiwang [5170 4949 2489]
Huang Liqun [7806 0448 5028]

ORG: Jin, Han, Yu, Feng, Wang Fansheng and Zhang Zhende all of the Shanghai Institute of Materia Medica, Chinese Academy of Sciences; Zhang Anzhong, Sheng and Lu all of the Shanghai First Medical College; Shi, Wang Lijuan, Hu and Wang Liqun all of the Shanghai First People's Hospital and the Shanghai First Tuberculosis Hospital

TITLE: "Role of Brain Serotonergic and Catecholaminergic Systems in Acupuncture Analgesia"

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp 121-132]

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp121-132

EXCERPT FROM ENGLISH ABSTRACT: Since neurotransmitters play an important role in many physiological functions, the elucidation of their interactions will greatly help to understand the mechanism of acupuncture analgesia. This paper reported the relationships between the action of brain monoaminergic systems and acupuncture analgesia in rats by means of several neuropharmacological manipulations.

AUTHOR: Ni Hui [0242 1979]
Wang Juming* [3769 5468 2949]
Zhuang Shouyuan [8369 1108 0337]

ORG: Department of Physiology, Nanking Medical College

TITLE: "Investigation of the Afferent Pathway in Facial Reflexes"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in
Chinese No 2, Apr 79 pp 133-140

TEXT OF ENGLISH ABSTRACT: Trigemino-facial reflex recorded in orbicularis oculi muscles bilaterally and initiated by stimulation of corresponding branches of trigeminal and facial nerve respectively were studied electromyographically in 30 normal persons and 11 patients in whom trigeminal or facial nerve was severed unilaterally. Close similarities in latency, wave pattern, frequency response and bilateral symmetry were found in these two reflexes. Facio-facial reflex was still present in contralateral facial muscles after sectioning one side of facial nerve. Stimulation of the cut stump of facial nerve anastomosed with accessory nerve still initiated reflex activities in bilateral facial muscles. On the contrary, after section of the trigeminal sensory

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp133-140]

root, stimulation of corresponding facial branch only evoked a direct response of the ipsilateral facial muscles, while no reflex activities were observed on both sides.

It is thus assumed that both facial reflexes have common afferent pathways, as the facio-facial reflex is initiated not by the excitation of facial afferent input, but is mediated by way of trigeminal nerve fibers which are activated due to the spread of stimulus. The existence of afferent fibers in facial motor branches and its participation in facio-facial reflex are disproved by our study.

The proprioceptive feedback input from facial muscles is supposed to arise from the exeroceptive activation of trigeminal nerve due to skin displacement induced by movement of facial muscles attached. Probably this mechanism may play an important role in the fine adjustment of superficial facial musculature in emotional expression.

The discussion of the afferent pathway in facial reflexes may give rise to a new clue for early diagnosis of intracranial brainstem lesions and other peripheral neuropathies involve

*Jiangsu Institute for Chinese Traditional Medicine

AUTHOR: Yang Qinzhaoh [2799 2953 3564]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "The Effect of Tetraethylammonium Ions on Crustacean Stretch Receptor Neurone"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 141-146

TEXT OF ENGLISH ABSTRACT: The effect of quaternary ammonium ions (choline, tetraethylammonium "TEA" and tetramethylammonium "TMA") upon the electrical activity recorded from the axon and soma of slowly adapting stretch receptor of the prawn (*Macrobrachium nipponensis*) and the shrimp (*Penaeus orientalis*) was studied. In contrast to the crustacean muscle fibre, the receptor neurone quickly became inexcitable when the external sodium was completely replaced by TEA, choline or TMA. The effect can be immediately reversed by washing in normal solution.

With the partial replacement of the external Na by TEA, there was a lengthening of the intracellularly recorded action potential. At a relatively high concentration of TEA, the falling phase always exhibited a plateau with a series of oscillations. During the

[continuation of SHENGLI XUEBAO no 2, Apr 79 pp 141-146]

plateau in the falling phase of the soma spike, the axon usually fired repetitively. The orthodromic repetitive discharges set up by a single antidromic stimulation were shown. The firing frequency was proportional to the TEA concentration. Such effects have never been observed with either choline or TMA at the same concentration.

AUTHOR: Shi Yuliang [2457 3768 2733]
Tan Depei [6223 1795 1014]
Xu Ke [1776 4430]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Free Amino Acids contents and Activities of Two Enzymes
Related to GABA in the Inhibitory and Motor Axons of Crayfish"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in
Chinese No 2, Apr 79 pp 147-152

TEXT OF ENGLISH ABSTRACT: By means of the method of ultramicro-electrophoresis on cellophane paper, the contents of γ -amino-butyric acid (GABA), aspartic acid, glutamic acid as well as the activities of glutamic decarboxylase (GDC) and (GABA- α -ketoglutarate transaminase (GABA-T) were determined in the single inhibitory and motor axons which innervate the opener muscle of the dactyl of the walking leg of crayfish (*Procambarus clarkii*). It was found that the concentration of GABA in the inhibitory axon was 0.13 per cent of wet weight, whereas no trace of GABA was detected in the motor axon (sensitivity of the method 0.4-1mM/Kg wet weight). No such difference was found with regard to other free amino acids, such as aspartic acid, glutamic acid and total neutral amino-acids

[continuation of SHENGLI XUEBAO No. 2, Apr 79 pp 147-152]

except GABA. In parallel to this finding the activity of GDC was only found in the inhibitory axon (1.2mM/Kg wet weight/hr), whereas that of GABA-T in both axons was about equal.

AUTHOR: Du Huanji [2629 3562 1015]
Zhao Yanfang [6392 3601 5364]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Effect of Destruction or Stimulation of Locus Coeruleus on Inhibition of Viscero-somatic Reflex Activities"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 153-161

TEXT OF ENGLISH ABSTRACT: The viscerosomatic reflex elicited by splanchnic nerve stimulation as recorded from the 11th intercostal nerve in Flaxedil immobilized cats could be inhibited by stimulation of the common peroneal nerve. Such inhibitory effect was found to be greatly enhanced following bilateral lesions placed in the coeruleus-sub-coeruleus complex. The enhancement of the inhibitory effects could be completely abolished by a lesion of the nucleus raphe magnus but not by decerebration or a lesion in the nucleus raphe dorsalis. Electrical stimulation of the coeruleus-subcoeruleus complex could reduce partly the inhibitory effect of peroneal nerve stimulation. The result of the present investigation would seem to suggest that the coeruleus-subcoeruleus complex and

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp 153-161]

and the nucleus raphe magnus may act antagonistically in the process of acupuncture analgesia.

AUTHOR: Zhang Zhende [1728 2182 1795]
Jin Guozhang [6855 0948 4545]
Han Yifan [7281 1837 0416]
Yu Leiping [0358 5628 1627]
Feng Jie [7458 3381]

ORG: Shanghai Institute of Materia Medica, Chinese Academy of Sciences

TITLE: "Effect of Acupuncture on the Level of Plasma and Brain Tryptophan"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 163-168

TEXT OF ENGLISH ABSTRACT: In rats treated with acupuncture, it has been demonstrated that the increase of pain threshold was associated with the elevation of the brain levels of tryptophan 5-HT and 5-HIAA. Acupuncture accelerated the transport of tryptophan from plasma into brain and augmented 5-HT neurons' activity. These results coincided with those pretreated with l-tryptophan or probenecid. The latter lowered the plasma total tryptophan, while acupuncture increased the total tryptophan. No matter what difference of the mode of action between them might exist, there was a

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp 163-168]

similar action to increase the level of brain tryptophan. It suggested that brain tryptophan concentration would be very important for acupuncture analgesia.

AUTHOR: Shi Yuliang [2457 3768 2733]
Tan Depei [6223 1795 1014]
Xu Ke [1776 4430]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Free Amino Acids Contents in Giant Nerve Fibers and Ganglionic Giant Nerve Cells of the Shrimp (*Penaeus orientalis*)"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 169-174

TEXT OF ENGLISH ABSTRACT: By the method of ultramicro-electrophoresis on cellophane paper, the contents of free amino acids (FAA) in the motor fibers, the medial giant fibers and in the giant nerve cells isolated from ganglions of abdominal nerve cord in the shrimp were determined. The results obtained were as follows:

1. The FAA contents in the motor giant fiber were much higher than those in the medial fiber. The concentrations of aspartic acid, glutamic acid and total neutral amino acids in the motor giants were respectively 7.5, 3.2 and 3.3 times higher than those in the medial fiber. Moreover in the motor giant fiber the concentration of aspartic acid was twice as high as that of glutamic acid, while

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp 169-174]

in the medial giant fiber no such difference was found.

2. The concentration of the acidic amino acids in these giant fibers of the shrimp was much lower than that in the nerve fibers of other marine animals, such as lobster, crab and squid. The concentration of the acidic amino acids in the medial giant fiber was even as low as that in the sciatic nerve of the toad.

3. The FAA contents in the abdominal ganglionic cells were much higher than those in the giant fibers. A considerable amount of γ -aminobutyric acid (0.13%) was found in the cells, but no trace of it could be detected in the fibers.

AUTHOR: Fan Shifan [5400 0013 5672]
Xu Sengen [1776 2773 2704]
Zhou Nianhui [0719 1819 6540]
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ORG: Fan, Xu and Zhou all of the Shanghai Institute of Physiology, Chinese Academy of Science; Wang of the Shanghai Institute of Materia Medica, Chinese Academy of Science

TITLE: "Effects of a New Potent Antiarrhythmic Drug Changrolin on the Electrical Activity of Myocardial Cells"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 175-184

TEXT OF ENGLISH ABSTRACT: The effects of a synthetic new potent antiarrhythmic drug Changrolin (4-{3',5'-bis[N-pyrrolidiny]methylene]-4'-hydroxyphenyl aminoquinazoline) on the electrical activity of the endocardial cells of the isolated ventricular septum of guinea pig stimulated repeatedly has been observed by means of capillary glass microelectrodes. After treating with Changrolin with concentration around $24\mu\text{g/ml}$, the membrane potential of the cell remained practically unchanged, yet the amplitude and the maximum depolarization rate of phase 0 of the action potential

[continuation of SHENGLI XUEBAO No 2, Apr 79 pp175-184]

decreased, the rate of repolarization of phase 2 increased while its duration shortened. In most cases the effective refractory period prolonged markedly. The above mentioned effects of Changrolin developed more promptly and prominently as the frequency of stimulation increased from 60 per minute to 200 per minute. Changrolin could decrease the frequency of spontaneous activity of the preparation as well as the rhythmic activity induced by ouabain. It could even abolish completely the rhythmic activity induced by aconitine. It was argued that Changrolin could alter the opening and closing processes of the sodium channel of the membrane during its activity by influencing the time course of development and restoration of the gating parameters m and h of the respective processes as well as increasing the parameter x_1 suggested by McAllister et al. which controls the ionic channel for the outward current during phase 2 of the action potential. The possible mechanism of antiarrhythmic action and the possible classification of Changrolin has been discussed on the basis of the observed effects of Changrolin on the electrical activity of myocardial cells.

AUTHOR: Peng Jiazhen [7458 -857 4176]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Further Evidence for the Post-denervation Hypertrophy in Chick Slow Muscle Fibers as a Specific Denervation Effect"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 185-189

TEXT OF ENGLISH ABSTRACT: In 1962, T. P. Peng et al. reported an unusual phenomenon of post-denervation hypertrophy in the chick slow muscle fibers. The present work presents further evidence to show that this phenomenon is a specific denervation effect. The sartorius muscle of the chick which is a mixture of slow and fast fibers was used in this work. Three procedures were used to induce inactivity in this muscle: (1) by isolation of the spinal cord segment containing its motoneurons; (2) by tenotomy and (3) by direct immobilization. Neither of these procedures led to the development of hypertrophy of the slow fibers in this muscle. However hypertrophy occurred, as to be expected, when the muscle was denervated in addition to spinal isolation.

AUTHOR: Yu Zonghan [0060 1350 3466]
Yao Quansheng* [1202 6855 0524]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Effects of Deoxycorticosterone Acetate on the Serum and Muscle Potassium, Sodium and Chloride of Rats"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 191-192

TEXT OF ENGLISH ABSTRACT: A solution of the powdered deoxycorticosterone acetate (DOCA) with a concentration of 40mg/ml was prepared with salad oil which contained 40% benzyl alcohol as solubilizer. After 10 mg DOCA per rat per day was injected intramuscularly for 10 days, the rat serum potassium and chloride were decreased simultaneously. Under the circumstances, the intracellular potassium of the "slow" muscle (soleus) was decreased markedly and the reduced intracellular potassium was replaced by sodium. This phenomenon did not appear in the "fast" muscle (extensor digitorum longus) significantly.

*Visiting research fellow.

AUTHOR: Chen Ming [7115 2494]
Shi Lilie [0670 7787 3525]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Absorption Spectra of the Rhodopsin of Two Species of Marine Fishes: *Decapterus maruadsi*, *Pneumatophorus japonicus*"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 193-196

TEXT OF ENGLISH ABSTRACT: The absorption and difference spectra of the digitonin extracts of the retina of two species of marine fishes, *Decapterus maruadsi* and *Pneumatophorus japonicus*, were determined in the presence of hydroxylamine at pH 8.4-8.6. By the method of partial bleaching the visual pigments of *Decapterus maruadsi* are identified to be a mixture of P488₁ and P510₁ with a compounded λ_{\max} at 492nm. The visual pigment of *Pneumatophorus japonicus* also belongs to retinal₁-based chromoprotein, but it appears to be a relatively homogeneous substance with an absorption maximum at 490nm, i.e. P490₁.

AUTHOR: Zheng Zehui [6774 0463 1979]
Wu Jianbing [0702 1696 1456]
Mao Jinbiao [3029 6855 2871]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "Intracellular Staining of Single Spinal Neurones with horseradish Peroxidase"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in Chinese No 2, Apr 79 pp 197-202

TEXT OF ENGLISH ABSTRACT: An attempt was made to stain single spinal cord neurones of cat with China-made horseradish peroxidase (HRP). After taking intracellular recordings from motor neurones or dorsal horn neurones 4% HRP was injected iontophoretically through the recording glass microelectrodes. In well-stained neurones, the soma, dendrites, dendritic spines, axon, axon collaterals, and also the terminal buttons were clearly visible against a clean background. The morphological features of a motor neurone and some dorsal horn neurones were described.

AUTHOR: Zhu Dexing [2612 1795 5887]
Ni Zimei [0242 4793 5019]

ORG: Shanghai Institute of Physiology, Chinese Academy of Sciences

TITLE: "A Self-made Simple Mechano-electric Transducer"

SOURCE: Shanghai SHENGLI XUEBAO [ACTA PHYSIOLOGICA SINICA] in
Chinese No 2, Apr 79 pp 203-207

TEXT OF ENGLISH ABSTRACT: A simple mechano-electric transducer
using semiconducting strain gauge is described. Owing to its
high sensitivity, high frequency response and low cost, it is
recommended for popular use.

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